Petra Bond Index Methodology

1. Index Specifications

- The Petra Bond Index is a rule-based, market value weighted index created to measure the performance of cedi denominated Government of Ghana bonds and notes.
- The Petra Bond Index will provide users with the following;
    a. Benchmark for active and passive Government of Ghana bond portfolios.
    b. Informational measures of Government of Ghana bond market performance and risk characteristics.
    c. Reference targets for passive investment strategies and index linked products.

1.1 Initial Value

- The Petra Bond Index will be calculated every business day starting, 1st of December 2019, with the index value of 1,000 as at the close of trading on 1st of December 2019.

1.2 Distribution

- Index values will be calculated and distributed daily via Petra Trust Company Limited website and mailing list.

1.3 Index Pricing and Analytics

1.3.1 Pricing

- All bonds in the index are marked to market.
- All bonds including off-the-run bonds are priced daily on the mid-side using indicative market yields. The price source is an average of Barclays Bank, Access Bank and Standard Chartered Bank indicative yields.
- The initial price for new bonds entering the index will be based on indicative price quotes from Barclays Bank, Access Bank and Standard Chartered Bank on the entry date. If a bond is eligible to enter the index on its primary issuance date, the primary market price, if uniform, will be used as the entry price. Otherwise, indicative price quotes from Barclays Bank, Access Bank and Standard Chartered Bank will be used.
- If price quotes for a constituent security for any given day in not available, the last available price is used.
- Index-eligible securities are quoted in “Ghana cedi prices” which represent the security’s value as a percentage of par.

1.3.2 Analytics

- Return on constituent securities will be measured using yield to maturity.
- Index weighted average yield will also be calculated using security market values as weight.
- The Petra Bond Index interest rate risk will be measured using the modified duration.
- In addition to modified duration, key rate duration will be calculated at eight (8) points on the curve: 1y,2y, 3y, 5y, 7y, 10y, 15y and 20y.

- While duration provides a linear approximation of interest rate sensitivity of bonds in the index funds, convexity will be calculated to provide a quadratic approximation that measures duration changes with changes in yields.
- The market value weighted average time to maturity of the index will be calculated.

1.4 Weighting

- The constituent bonds are weighted according to their respective market value in proportion to the aggregated market values of all constituent bonds in the Index.

- $Market\ Value_{Bond} = (Price_{Bond} + Accrued\ Interest_{Bond}) * Par\ Amount\ Outstanding_{Bond}$

1.5 Historical Data

- Historical data will be maintained from December 01, 2019.

2. Composition of the Index (selection, rebalancing and reconstitution)

2.1 Selection of the index components

All eligible Government of Ghana bonds will be added at the start of the index. The index will have an adjustment day which falls on the last business day of each month. New bonds issued prior to the adjustment day and which meet the selection criteria defined below will be added on adjustment day. Additionally, on the adjustment day, the index committee will evaluate whether all current constituent securities still meet the requirements for selection. Constituent securities that do not meet the selection criteria will be removed from the index on the adjustment day.

2.2 Petra Bond Index Selection Criteria:

- Bonds must be issued by the Government of Ghana, issued on the domestic market and denominated in Ghana Cedi.
- Bonds must have fixed rate periodic coupon with bullet principal payments.
- Bonds must be listed on the Ghana Fixed Income Market.
- Bonds should have at least GHC 500,000,000.00 in size outstanding.
- Bonds with partial or fully amortizing principal payment structures will not be included in the index.
- Bonds whose time to maturity fall below one year will not be eligible to enter the index.
- Floating rate bonds, step-up coupon bonds, index linked coupon bonds, payment-in-kind coupon bonds and deferred coupon bonds will not be included in the index.
- Bonds with embedded options will not be included in the index.
- Securitized bonds will not be included in the index.

2.3 Rebalancing and Adjustment Rules

- The composition of the Index is periodically rebalanced (monthly) on the adjustment day, which falls on the last business day of each month. This will offer intra month stability to index composition. The index settlement date is set for the first calendar day of the following month.
- Constituent securities will be held constant throughout the month from the previous index adjustment date. This fixed universe will be used to calculate daily and monthly index returns and is the basket of bonds against which fund managers will be measured.
- Eligible bonds issued but not necessarily settled on or before the month-end adjustment date will qualify for inclusion in the following month's index, provided the required security's reference information and pricing are readily availability.
- Gross index turnover, which measures the index composition shift will be measured using the market values of bonds leaving and entering the index (as a percentage of the index's beginning market value).
- Intra-month cash payments into the index (coupon and principal payments) earns no reinvestment return during the month.
- Any accumulated coupon payment is stripped out of the index on adjustment day and effectively reinvested pro rata across the entire index for cumulative returns purposes. Cumulative returns for periods longer than one month reflect monthly compounding.
- Any accumulated principal payments are redeemed from the index on the adjustment day.
- New bonds eligible to enter the index are added on the adjustment day for settlement on the first calendar day of the following month. This will enable the index to reflect the latest set of eligible securities on a monthly basis.
- Securities whose time to maturity fall below one year will be index-ineligible and will be referred to as drops.
- On each month end adjustment day, securities falling below one year to maturity in the following month will be dropped from the index. This will ensure that all constituent securities always have time to maturity greater than 1 year.

3. Index Calculation and Aggregation

3.1 Index Formula

- The Petra Bond Index is a standard total return index with market value weights and recognizes price changes, accrued interest and other cash payments.
- The total return is calculated by aggregating the interest return, reflecting the accrued interest, and price return, reflecting the gains or losses due to changes in the indicative price quotes.
- Aggregation of security level duration is achieved by summing the weighted average Macaulay duration of each bond. The capital value ($Capital\ Value_{Bond} = Price_{Bond} * Par\ Amount\ Outstanding_{Bond}$) of each security is used as weight.

Formula:

$Total\ Return\ (TR_i)$ = $(MVE_i - MVB_i + Cashflow)/MVB_i$

$Weight\ (W_i)$= $MVB_i/\sum_{i=1}^{n} MVB_i$

$Index_t$ = $Index\ _{t-1}$*$(1 + \sum_{i}^{n} Total\ Return_{i,t} * Weight_{i,t-1})$

Where:

$MVE_i = Market\ Value\ of\ security\ i\ at\ period\ end$

$MVB_i = Market\ Value\ of\ security\ i\ at\ begining\ of\ period$

$MV_i = Market\ Value\ of\ security\ i$

$W_i = Market\ capitalisation\ of\ security\ i$

$Market\ Value_{Bond} = (Price_{Bond} + Accrued\ Interest_{Bond}) * Par\ Amount\ Outstanding_{Bond}$